

The listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

1. – 18. (Cancelled)

19. (Currently Amended) An apparatus, comprising:

a flip chip integrated circuit having flip chip bond pads with solid solder bumps formed directly on an active surface of the flip chip; and

a substantially uniform layer of B-staged, underfill adhesive that is partially cured and reflowable, the B-staged underfill adhesive being applied as a flowable material directly on the active surface of the flip chip integrated circuit and around the solder bumps ~~formed onto the active surface~~, the substantially uniform layer of underfill adhesive and the flip chip integrated circuit together forming continuous cut edges around the periphery of the flip chip, the partially cured reflowable underfill adhesive having properties suitable for reflowing during solder reflow of the solder bumps at a solder reflow temperature when the flip chip is being mounted onto a substrate so that the reflowable underfill material substantially fills the gap between the flip chip and the substrate and further cures in the gap between the flip chip and the substrate, and wherein prior to reflow the B-staged underfill adhesive conformally surrounds the solder bumps with substantially no gap between the B-staged adhesive and the solder bumps.

20. (Original) The apparatus of claim 19, wherein the underfill adhesive includes one or more of the following components: an epoxy resin, a hardener, a catalyst initiator, a coloring dye, and an inorganic filler.

21. (Previously Presented) The apparatus of claim 19, wherein the underfill adhesive has a coefficient of thermal expansion substantially similar to that of the substrate upon which the flip chip integrated circuit is intended to be mounted.
22. (Original) The apparatus of claim 19, wherein the underfill adhesive is deposited on the active surface of the flip chip integrated circuit at a pre-cured height such that the solder bumps are at least exposed through the underfill adhesive after curing.
23. (Original) The apparatus of claim 22, wherein the pre-cured height of the underfill adhesive applied to the wafer ranges from 140% to 90% of the height of the solder bumps.
24. (Previously Presented) The apparatus of claim 19, wherein the underfill adhesive layer is deposited on the active surface of the flip chip integrated circuit in wafer form before the flip chip integrated circuit is singulated from the wafer.
25. (Previously Presented) The apparatus of claim 19, wherein the underfill adhesive is selected from the group comprising: epoxies, poly-imides, silicone-polyimide copolymers.
26. (Previously Presented) The apparatus of claim 19, wherein the substrate has a plurality of contact pads, the contact pads configured to contact the solder bumps of the flip chip when the flip chip is mounted onto the substrate, the contact pads and the solder bumps forming joints electrically connecting the flip chip to the substrate.
27. (Cancelled)

28. (Previously Presented) The apparatus of claim 19, wherein the layer of underfill adhesive is substantially opaque thereby protecting the flip chip integrated circuit from photo induced leakage currents by blocking visible light.

29. (Original) The apparatus of claim 19, wherein the underfill adhesive has a coefficient of thermal expansion in the range of approximately  $20 \times 10^{-6}/K$  to approximately  $30 \times 10^{-6}/K$  @ 25 °C.

30. (Original) The apparatus of claim 19, wherein the underfill adhesive melts at between 120 to 140 degrees C and reacts at between 175 to 195 degrees C.

31. (Original) The apparatus of claim 19, wherein the underfill adhesive has an elastic modulus in the range of 1 to 10 GPa.

32. (Previously Presented) The apparatus of claim 24, further comprising a dam around the periphery of the wafer to prevent the underfill material deposited onto the surface of the wafer from flowing off the wafer before the partial curing of the adhesive layer.

33. (Cancelled)

34. (Previously Presented) The apparatus of claim 26, wherein a fluxing material is provided on the substrate.

35. (Previously Presented) An apparatus, comprising:

a semiconductor wafer having an active surface including a plurality of die formed thereon;

one or more bond pads formed on the plurality of die;

one or more solid solder bumps formed on the one or more bond pads respectively; and

a layer of B-staged underfill adhesive that is partially cured and reflowable, the B-staged underfill adhesive being formed around the solder bumps on the active surface of the wafer, the reflowable underfill adhesive having properties suitable for reflowing during solder reflow of the solder bumps at a solder reflow temperature when the individual die are being mounted onto a substrate so that the reflowable underfill material substantially fills the gap between the individual die and the substrate and further cures in the gap between the flip chip and the substrate, and wherein prior to reflow the B-staged underfill adhesive conformally surrounds the solder bumps with substantially no gap between the B-staged adhesive and the solder bumps.

36. (Previously Presented) The apparatus of claim 35, wherein the underfill adhesive is deposited on the active surface of the wafer at a pre-cured height such that the solder bumps are at least exposed through the underfill adhesive after the partial curing.

37. (Previously Presented) The apparatus of claim 36, wherein the pre-cured height of the underfill adhesive applied to the wafer ranges from 140% to 90% of the height of the solder bumps.

38. (Previously Presented) The apparatus of claim 35, wherein the underfill adhesive is selected from the group comprising: epoxies, poly-imides, silicone-polyimide copolymers.

39. (Previously Presented) A apparatus claim 35, wherein the layer of underfill adhesive is substantially opaque.

40. (Previously Presented) The apparatus of claim 35, wherein the underfill adhesive has a coefficient of thermal expansion in the range of approximately  $20 \times 10^{-6}/K$  to approximately  $30 \times 10^{-6}/K$  @ 25 °C.

41. (Previously Presented) The apparatus of claim 35, wherein the underfill adhesive melts at between 120 to 140 degrees C and reacts at between 175 to 195 degrees C.

42. (Previously Presented) The apparatus of claim 35, wherein the underfill adhesive has an elastic modulus in the range of 1 to 10 GPa.

43. (Previously Presented) An apparatus comprising:

- a semiconductor wafer having an active surface including a plurality of dice formed thereon;

- a plurality of bond pads formed on each of the plurality of dice;

- a plurality of solder bumps, each solder bump being formed on an associated bond pad;

and

- a layer of B-staged underfill adhesive that is partially cured and reflowable, the B-staged underfill adhesive being formed around the solder bumps on the active surface of the wafer, the reflowable underfill adhesive having properties suitable for reflowing during solder reflow of the solder bumps at a solder reflow temperature when the individual die are being mounted onto a substrate so that the reflowable underfill material substantially fills the gap between the

individual die and the substrate and further cures in the gap between the flip chip and the substrate; and

a dam around the periphery of the wafer to prevent the underfill material deposited onto the active surface of the wafer from flowing off the wafer before the partial curing of the adhesive layer.